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Digital Currency/Electronic Payment: Hybrid Delivery Mode

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About this working paper

This is the third paper in a series of working papers that the authors have developed from their digital RMB project report on "China's e-CNY Journey: Design and Development". China began piloting its central bank digital currency in 2019. The trial programme now covers twenty-six cities and involves more than five million merchants. This working paper series examines the digital RMB's systems design and policy objectives, performance expectations and technology support, and hybrid delivery mode.

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Highlights

- A shared Chinese perspective stresses that currency encompasses a comprehensive set of institutional arrangements behind explicit payment and settlement, including design principles, issuance frameworks, operational mechanisms, and management systems.
- The operation process of the digital RMB consists of three key stages: issuance; distribution; circulation. The core elements of the issuance stage are composed of "one coin, two repositories, and three centers".
- The "two-tier" architecture adopted at the distribution and circulation levels accredits both the PBC and designated commercial banks and fintech companies as crucial operational entities in the DC/EP industrial chain.
- In promoting the application of the digital RMB, the tier-two operational entities are expectedly seeking cooperation from other thousands of banks and numerous mobile payment providers, hence giving rise to 2.5-tier "collaborators/partners".
- The role delineations, functional boundaries, system guarantee for fair market competition, and risk control mechanisms between and among tier 2.0 and tier 2.5 operating institutions remain ambiguous.
- Discussions continue about channels for tier 2.5 agencies to generate income if the digital RMB involves no handling or transaction fees.
- China's efforts to list "data" as one of the five essential factors of production, alongside land, labor, capital, and technology, present the digital RMB with not only opportunities to stimulate the productivity of the "data factor" in the era of the digital economy, but also challenges in the protection of privacy of users' data, clarifying data permissions of financial institutions, and defining responsibilities and authorities of regulatory agencies at all levels.

Introduction

In China's public discussions on the digital RMB, a widely shared perspective stresses that currency is not merely a universal equivalent used for payment and settlement. Nor is it just a physical object serving as a currency carrier, such as gold, silver, copper, paper, ledger symbols, electronic digits, or encrypted codes of digital technology. Rather, it encompasses a comprehensive set of institutional arrangements behind explicit payment and settlement, including design principles, issuance frameworks, operational mechanisms, and management systems. In other words, the most explicit purpose of currency is to facilitate payment. While this is closely related to the form of currency carriers, what truly ensures convenient and secure payments lies in the implicit institutional arrangements.[1]

According to the PBC's CBDC research and development group and Chinese finance academic circles, the design of the digital RMB system follows the principles of "safety and inclusiveness, innovation and ease of use, and long-term evolution". The design also takes into consideration currency functions, market demands, supply models, technological support, and cost effectiveness. In the development of the operational model and the ecological system of the digital RMB, an open and inclusive approach is taken to fully leverage existing financial infrastructures. In accordance with the long-term evolution strategy,

technological competition and iteration are encouraged to maintain overall technological advancement and to avoid excessive concentration of operational risks in the system.[2] Encouraging business expansion and service competition in the digital RMB market and highlighting the need for security and compliance in the innovation of related financial products both underscore the importance and necessity of establishing a comprehensive lifecycle management mechanism for the digital RMB.[3]

At the issuance level, the reported core components of the digital RMB network are "one coin, two repositories, and three centers". "One coin" refers to the DC/EP tokens with specific face values issued and guaranteed by the central bank. "Two repositories" stand for the "digital currency issuance database" and the "digital currency commercial bank databases". "Three centers" cover registration, authentication, and big data analysis, which are responsible for identity verification, certificate issuance, and transaction flows monitoring.[4]

At the delivery and circulation levels, the digital RMB adopts a "two-tier operation" model, wherein the central bank issues the legal digital currency to designated commercial banks and other operating institutions, which then provide front-end services for exchange and circulation to the public.[5] Analyses from China's finance research and business communities indicate that this "dual framework" arrangement should effectively consolidate the sovereign status of the digital RMB, while giving full play to the technical and talent advantages of existing commercial banks and third-party payment platforms. This approach is believed capable of assisting in preventing "financial disintermediation" and improving allocative efficiency.[6] It can also avoid the situation where more than a billion people crowd the central bank to open digital RMB accounts and use channels. In sum, the two-tier operating system not only disperses risks and eases the pressure on the central bank, but also facilitates the more efficient promotion and adoption of the DC/EP.[7]

The PBC-designated operators of the digital RMB include China's six largest commercial banks (Industrial and Commercial Bank of China, Agricultural Bank of China, Bank of China, China Construction Bank, Bank of Communications, and Postal Savings Bank of China), two joint-stock banks (China Merchants Bank and Industrial Bank), and two internet-only banks (MYBank and WeBank).[8] To ensure widespread availability of the digital RMB, the PBC also permits other banks and payment institutions to collaborate with the ten designated operating institutions, after clarifying rights and responsibilities, in providing the e-CNY circulation services. These entities are referred to as "2.5-tier" operating institutions in the Chinese financial market.[9]

The operators in this group consist primarily of various small and medium-sized banks, rural credit cooperatives, and other financial and non-financial institutions. Although the "two-tier operation" model of the digital RMB does not include sub-tier levels, the "Tier 2.5" entities are regarded by the market as the "bridge" between the designated operating institutions and the public in the DC/EP ecosystem.[10] Chinese finance and fintech professionals further point out that to ensure the robust and compliant operation of the digital RMB issuance, exchange, transactions, and circulation, continuously fine-tuning the operational architecture is a must. This will facilitate the effort to optimise the functional boundaries between the 2.0-tier and 2.5-tier operating institutions so as to activate and maintain the enthusiasm of the 2.5-tier participants. Continued efforts should also be made to integrate the DC/EP's basic payment capabilities and to glaze them with personalised features for the provision of comprehensive financial services to the public. These pursuits are emphasised as being essential determinants of a smooth landing of the digital RMB.[11]

DC/EP Issuance Structure: Core Components and Functions

According to analyses from China's finance research and business communities, the operation process of the digital RMB consists of three key stages: issuance, distribution, and circulation. The core elements of the issuance stage are composed of "one coin, two repositories, and three centers".[12] "One coin" refers to

the design elements and data structure of the digital currency, which are under the responsibility of the central bank. It takes the shape of an encrypted digital string with specific nominal value. In other words, the DC/EP is not an account balance represented by electronic money, but a state-sponsored virtual currency that carries complete transaction relevant information.[13]

"Two repositories" refer to the digital currency issuance database and the digital currency bank database. The former is where the PBC stores the digital currency issuance fund in the DC/EP's private cloud ecosystem. The latter indicates where commercial banks store the digital RMB, locally or in the DC/EP's private cloud ecosystem.[14] Specifically, the central bank issues the digital RMB to the digital currency depositaries of the designated commercial banks and financial institutions for which the designated operators pay reserves, which enter the central bank's digital currency issuance repository.[15] Chinese finance researchers and professionals emphasise that while the "two repositories" design seems to simulate the issuance process of physical currency, its main goal is to create a more secure storage and application execution space for the digital RMB.[16]

Among the "three centres", the registration centre tracks the entire process of the digital RMB issuance, transfer, and withdrawal, and provides distributed ledger services to ensure consistency in ownership information between the central bank and commercial banks. The authentication centre manages the identity information of institutional and individual users of digital RMB wallets. It is viewed as a basic component of system security and as playing an important role in delivering the "controllable anonymity". The big data analysis centre leverages technologies such as big data and cloud computing to process massive transaction data. Through analysing payment behaviour and regulatory control indicators, it monitors the flow of currency to ensure the security of digital RMB transactions, prevent money laundering and other illegal activities, and provide data support for macroeconomic policy implementation.[17]

Many in China's finance academic and business communities conclude that the design of the "three centres" is built on the fact that in DC/EP transactions, it is the central bank that ultimately confirms ownership changes. As the currency issuer and the entity responsible for the distribution of private keys in user wallets and transaction authentication, the central bank's "three centres" can obtain user information, oversee the entire process of issuance, transfer, and withdrawal, and analyse transaction data through the big data centre.[18] In other words, due to the information-carrying capability of the digital RNB, when it becomes the primary currency for economic activities in the digital space, the central bank may potentially dominate the information of all payments and corresponding users, and the entire transaction data. This will place the PBC at the upstream of the entire data resource value chain.[19]

The above logic is accompanied by the belief that the digital RMB will be able to redefine the interaction among payments, economic activities, and user data. The transformation will in turn effectively eliminate the current fragmentation of mobile payment usage scenarios by fintech payment platforms. The makeover will provide users with a personal "super account" applicable to all business platforms and lay the necessary infrastructure for the value circulation of data assets across society.[20] The "three-centers" design is thus widely considered to also align with China's recent efforts to list "data" as one of the five essential factors of production, alongside land, labor, capital, and technology.[21]

The formal "upgrading" of data as "new" means of production is further expected to speed up data assetisation and capitalisation, enabling data to participate in the entire process of social production and management.[22] However, many Chinese academic and public discussion circles also warn that the digital RMB faces not only opportunities to fully stimulate the productivity of the "data factor" in the era of the digital economy. Given that relevant laws and regulations are still sketchy, the digital RMB also faces significant challenges in protecting the privacy of users' data during usage, clarifying the data permissions of banks and other financial institutions, and defining the responsibilities and authorities of regulatory agencies at all levels.[23]

DC/EP Operation System: Interactions between PBC and Commercial Banks

Clearly, "how to issue" the digital RMB, including release, withdrawal, and tracking, and "how much to issue", involving the control of the supply quantity and frequency, all revolve around the core system of "one coin, two repositories, and three centres". Yet, "how to use" or operate the digital RMB is a matter closely related to the public. Therefore, it is widely recognised in Chinese finance research and business communities that at the circulation level, the DC/EP should adopt a hybrid mode of "two-tier operation". Specifically, the central bank is responsible for issuing the digital RMB to designated commercial banks and fintech platforms and for managing the currency's entire life cycle, while the latter take charge of its market-oriented design and operation to ultimately serve the public and the real economy. [24]

It is also generally believed that the adoption of a two-tier operational system helps reduce the PBC's development pressure and technostress in issuing and operating the digital RMB. Leveraging the readily available and mature electronic information systems and service networks of commercial banks and other financial institutions also enables the central bank to execute an efficient and effective delivery of the digital RMB to the public. Moreover, should a single-tier operational mechanism be adopted, the public may withdraw deposits from commercial banks to exchange for the digital RMB with the central bank. This would create a competitive relationship between the digital RMB exchange and commercial bank deposits. The flow of the RMB back to the central bank and the resultant decrease of deposits may in turn affect the lending capacity of commercial banks and increase their reliance on the interbank market. This situation may lead to higher costs of funds and social financing, which may seriously harm the real economy. Hence, the digital RMB operates within a two-tier structure.[25]

The conceptual representation of the two-tier operational architecture is that in the first tier, the central bank exchanges digital renminbi with designated commercial banks and fintech platforms based on a 100% reserve requirement. The full reserve system ensures that the DC/EP is a currency with real value, a liability of the central bank, and a sovereign currency of the country.[26] Under the centralised management of the PBC, designated operational agencies in the second tier open different types of digital RMB wallets for customers based on their identity verification strength. They also provide services for exchanging, redeeming, and circulation of the digital RMB and manage retail payment transactions.[27]

Judging by publicly available information, the PBC does not have any preset technical route for the second tier. Many Chinese finance professionals thus believe that operating agencies should be encouraged to compete with one other by creating distinctive technical routes and providing differentiated services to users. It follows that at the infrastructure level, the PBC must not only verify the security and effectiveness of the various technical routes, but also ensure their interoperability to perform its regulatory functions effectively.[28]

Furthermore, given that the research and development of the digital RMB follow the principle of "technology neutrality", curiosities have emerged from China's public discussion circles about the possibility of applying distributed ledger technology (DLT), which supports cryptocurrencies, in the operation of the DC/EP. In their response, Chinese finance researchers and professionals point out that neither the PBC nor Chinese commercial banks use DLT for clearing and settlement.[29] Considering the existing efficiency bottlenecks of the technology and China's large population base and high frequency of non-contact transactions, the overall possibility of applying DLT to the retail end of the digital RMB should be relatively low.[30]

With or without DLT, the two-tier architecture is widely acknowledged in the Chinese financial industry to have accredited the designated commercial banks and fintech companies as the most crucial operational entities responsible for exchange and circulation in the entire digital RMB industrial chain. Pilot projects in some regions have already shown that the two-tier operation model can create a completely new user

interaction scenario and customer acquisition channel for financial institutions. It thus follows that once the digital RMB achieves broader adoption in the future, its impact on user traffic will further increase.[31]

However, some voices in China's finance research communities also point out that since the digital RMB is still in the pilot phase, specific arrangements of the "two-tier architecture" are still unclear. In particular, the role delineations and functional boundaries of the operational institutions remain somewhat ambiguous.[32] Furthermore, the designated commercial banks and fintech companies typically task their technology and internet finance departments with the responsibility of participating in the business and technical development of the digital RMB pilot projects, and their branches in the pilot cities the responsibility of carrying out the trials. As different departments and staff members may have limited or different knowledge of currency circulation and accounting operations, their understanding of and arrangements for the DC/EP operations may vary, which may exert different effects on China's e-currency explorations. Therefore, to ensure a smooth issuance of the digital RMB, the building of the "two-tier operational framework" should include organised and regularly updated training for people in all participating departments and at all levels.[33]

DC/EP Application Management: Two Tiers Open to Intermediary Networks

Under the two-tier operational framework, individual and business users should, in principle, engage with the digital RMB only through the central bank and/or authorized operational institutions. While it is not ruled out that more commercial banks and e-payment service providers may join in the future, the financial institutions that can become "designated" operational entities will remain "as rare as hen's teeth". Therefore, in promoting the application of the digital RMB, the designated operational institutions are widely expected to seek cooperation from other thousands of banks and numerous mobile payment providers and telecommunication operators in China.[34]

This expectation has in fact already materialised as the e-CNY pilot programmes launched in 2019 have given rise to a 2.5-tier "collaborators/partners", who are now playing an "important role" in the DC/EP system.[35] Many studies in China indicate that the 2.5-tier includes joint-stock banks, urban and rural commercial banks, private banks, village banks, and third-party payment platforms. They are mainly responsible for connecting the ten designated operational institutions with the public and facilitating the circulation of the digital RMB in economic activities and daily life. In other words, these financial agencies do not have the capability to exchange the digital RMB with the central bank, and therefore cannot create new digital RMB.[36]

Many banking professionals in China point out that the more 2.5-tier commercial banks and fintech companies participate in the pilot, the more diverse the application scenarios of the digital RMB will become, and the more enriched the customer experience in the pilot areas will be. Additionally, working from their own business settings, the 2.5-tier agencies should also be able to help push forward the development of enabling environments for the digital RMB rollout, particularly in county-level districts and rural areas.[37] As it happens, Chinese financial institutions of all types and at all levels have also shown great enthusiasm and eagerness in participating in the 2.5-tier system. For example, the Industrial Bank Co., Ltd. signed cooperation agreements with 97 collaborators/partners and accomplished full coverage of the DC/EP pilot areas in the first year after it was designated as the 10th digital RMB operator by the PBC on 13 July 2022.[38]

Studies from China's finance research and professional circles further indicate that the ways of coupling the "2.5-tier" entities with the authorised digital RMB operational institutions can be roughly divided into "direct" and "indirect" connection access. In the direct connection mode, the authorised operational institutions furnish their "2.5-tier" collaborators with the capability to open and use digital RMB wallets through technical interfaces. The latter can then implement various functionalities such as digital wallets, merchant acquiring services, and online payments through their own channels. In contrast, indirectly

connected "2.5-tier" partners need to first link up with other intermediary agencies which may then help them get enlisted by the authorised operational institutions.[39]

Although operating differently, the two access models are considered to have similar advantages. For example, they both benefit from low entry thresholds, short docking periods, and quick innovation outputs in business functionalities. To expand their digital RMB business, they both can leverage platforms of the authorised operational institutions for application scenarios innovation and promotion. Moreover, the operational institutions generally share their own channel entrances with their "2.5-tier" collaborators. This type of arrangements has positive effects on "2.5-tier" institutions in their expanding customer base and increasing traffic introduction channels.[40]

However, research from China's financial industry also signals challenges that the 2.5-tier ecosystem presently faces. Firstly, the ten authorised operational institutions are themselves commercial banks and fintech payment enterprises, and their business overlaps significantly with that of their 2.5-tier collaborators. If they over-exploit their first-mover advantage, their operations may lead to a decline of, or even crush, market competition.[41] They can also leverage their wallet brands and technological advantages to encroach upon the business and customer space of the 2.5-tier financial enterprises, resulting in asymmetric competition.[42] Even if the system design ensures fair market competition, customers may still view differently the reputation and service capabilities of tier 2.0 and tier 2.5 institutions, which may eventually lead to an unfair competition.[43]

Comments from the Chinese financial industry further stress that the entire transaction process of the e-CNY is currently free of handling fees. This arrangement may not cause many concerns to the 2.0-tier institutions as they likely view their participation and investment in the operation of the digital RMB from national and corporate strategic perspectives.[44] Meanwhile, 2.5-tier small and medium-sized banks are also recognised as important players in the DC/EP ecosystem. By joining in the operation of the digital RMB, they can drive traffic to their services platforms and draw in more customers. Given that the e-CNY offers no interest payment, 2.5-tier banks may develop competitive high-yield wealth management products to attract their clients' digital wallets balances. This may provide both small banks and their customers with channels to generate income.[45]

Nevertheless, non-bank payment institutions at tier 2.5, such as third-party payment platforms, will not receive corresponding compensation for their serving as digital RMB transaction channels, unless the government decides to subsidise their operations.[46] Furthermore, as important participating operators of the digital RMB, non-bank institutions need to invest in the maintenance, transformation, and upgrading of their terminal facilities and services. If no handling or transaction fees are charged in the process, their survival could become problematic.[47]

Currently, the DC/EP is still in its trial stage, and the scale of circulation services provided by 2.5-tier institutions is limited. Therefore, their operations are not significantly affected for the time being. Yet as the acceptance scale of the digital RMB continues to expand, issues related to proceeds mechanisms of operating agencies and competition and profit fairness between the 2.0 and 2.5 tiers, need to be jointly addressed by the central bank + the 10 authorised operational institutions + *n* 2.5-tier collaborators/partners. The collaboration and joint effort may also generate insights and ideas for continued improvement of corresponding policies, laws, and regulations.[48]

Some experts in China's finance and fintech sectors further suggest an "explore-worthy" path towards fair and productive competition between the 2.0 and 2.5 tiers. Specifically, in order for them to complement each other's services, the 2.0-tier institutions should be designated to provide and maintain the basic payment capabilities of the digital RMB system, while their 2.5-tier collaborators/partners be delegated to deliver all the value-added services. By doing so, the two tiers would form "custodial" rather than "supervisor-subordinate" or "manager-employee" relationships. A partnership as such would incentivise

2.5-tier operators to take advantage of their being payment aggregators, provide customers with more comprehensive financial service platforms, and thereby enhance their market competitiveness.[49]

Meanwhile, 2.5-tier institutions also need to be further categorised and grouped based on their business nature and scope. In the accordance with the classification, their specific rights, interests, and responsibilities should be clarified to help regulatory authorities better understand their respective roles and obligations. Reducing the potential for distortion and inefficiency in 2.5-tier business behaviours caused by power-responsibility asymmetries should in turn strengthen the foundation for the continued expansion of the digital RMB pilot programme.[50]

For their part, 2.5-tier institutions should proactively improve their ability to identify, control, and eliminate risks that may emerge in servicing and providing technical maintenance to digital RMB accounts. This may require them to develop effective risk monitoring models for customer access audit and account management. Furthermore, 2.5-tier agencies should work closely with their collaborators among the 10 authorised operational institutions to establish joint risk control mechanisms. A clear division of responsibilities is of particular importance when the two partner groups need to share essential customer data for their operations. 2.5-tier institutions should make sure that the joint risk control mechanisms include tools and measures for effectively protecting customer information and sustaining business growth.[51]

Conclusion

The DC/EP is not only a payment tool, but also a comprehensive institutional arrangement, encompassing design principles, an issuance framework, operational mechanisms, and management systems. Nevertheless, its M0 identity and two-tier operational structure result in the DC/EP focusing on its becoming part of everyday life in China. Correspondingly, Chinese commercial/retail banks and financial intermediaries are designated as key handlers of the e-CNY's public interface.[52]

The central bank's effort to engage these stakeholders is widely seen in China as sensible given their relatively high levels of digital maturity, reasonably well-developed mobile payment infrastructure, and extensive experience in interacting with customers.[53] By extensively leveraging of existing technical and human resources, rather than "reinventing the wheel", the PBC may cost-effectively turn the DC/EP vision into action and smoothly boost the public's acceptance of the e-CNY.[54] However, irrespective of the PBC's effort to involve commercial institutions and not to pre-set a technical route, the digital RMB is widely anticipated to change the "rules of the game" in China's financial services sector and subsequently impact the existing financial architecture.[55]

The potentially "transformational" change continues to trigger research and business curiosity. Among the most frequently asked questions are: (1) whether and how the DC/EP will ensure fair competition in the "reshaped" digital payment landscape? (2) what fees and how much the financial industry may charge to cover the costs of providing e-CNY services to the public?[56] and (3) how the non-interest-paying digital RMB may increase its attractiveness and competitiveness on the financial markets?[57] Still, a more thought-provoking question is: should a "brake" function be built into the DC/EP, even though it is intended to give China's digital economy "super impetus"?[58] That there is still no announced date for the full-scale launch of the e-CNY indicates that explorations for answers to questions as such are yet to be completed.

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